Jet Propulsion Laboratory
California Institute of Technology

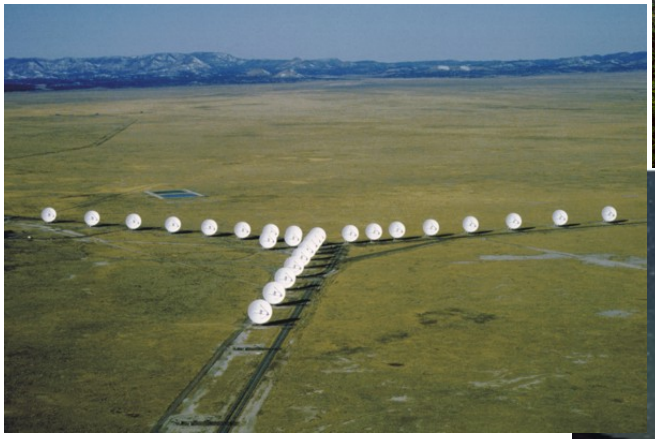
Radio Interferometry from Space

Astronomy's New Frontier

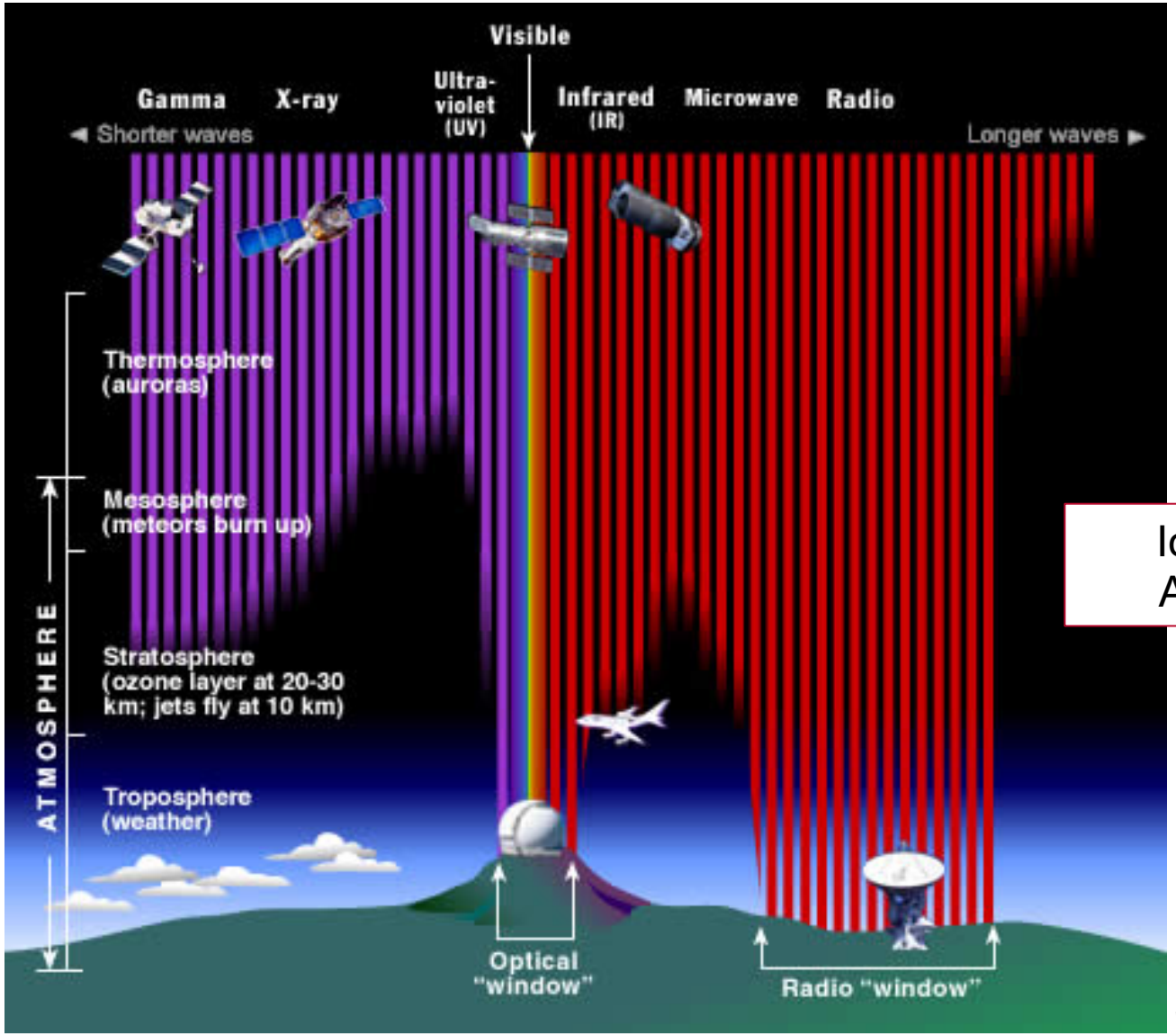
Joseph Lazio

2018 December 12

Space?



Radio Window is Wide Open!

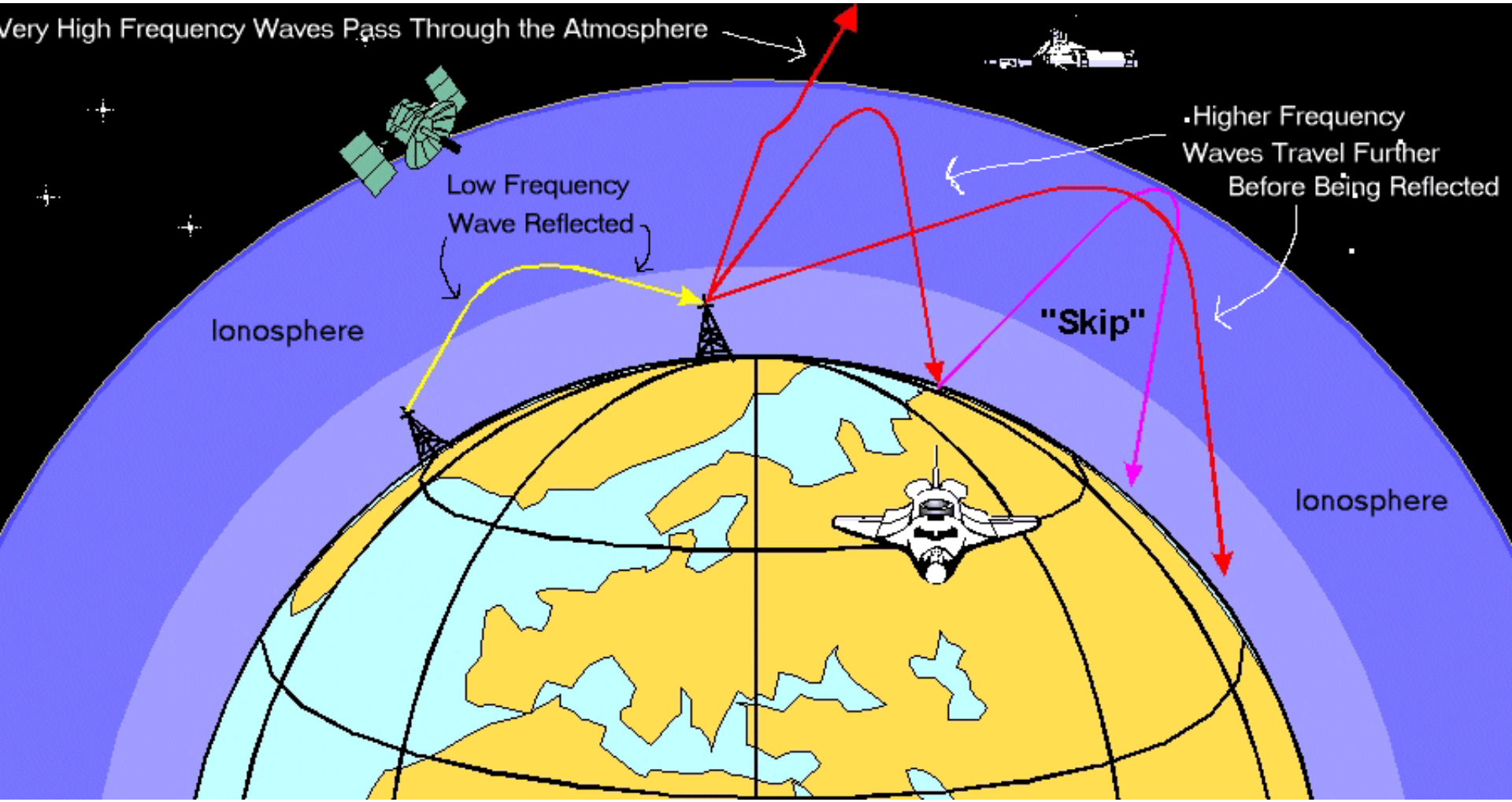


Or is it?

Ionospheric Absorption!

STScI/JHU/NASA

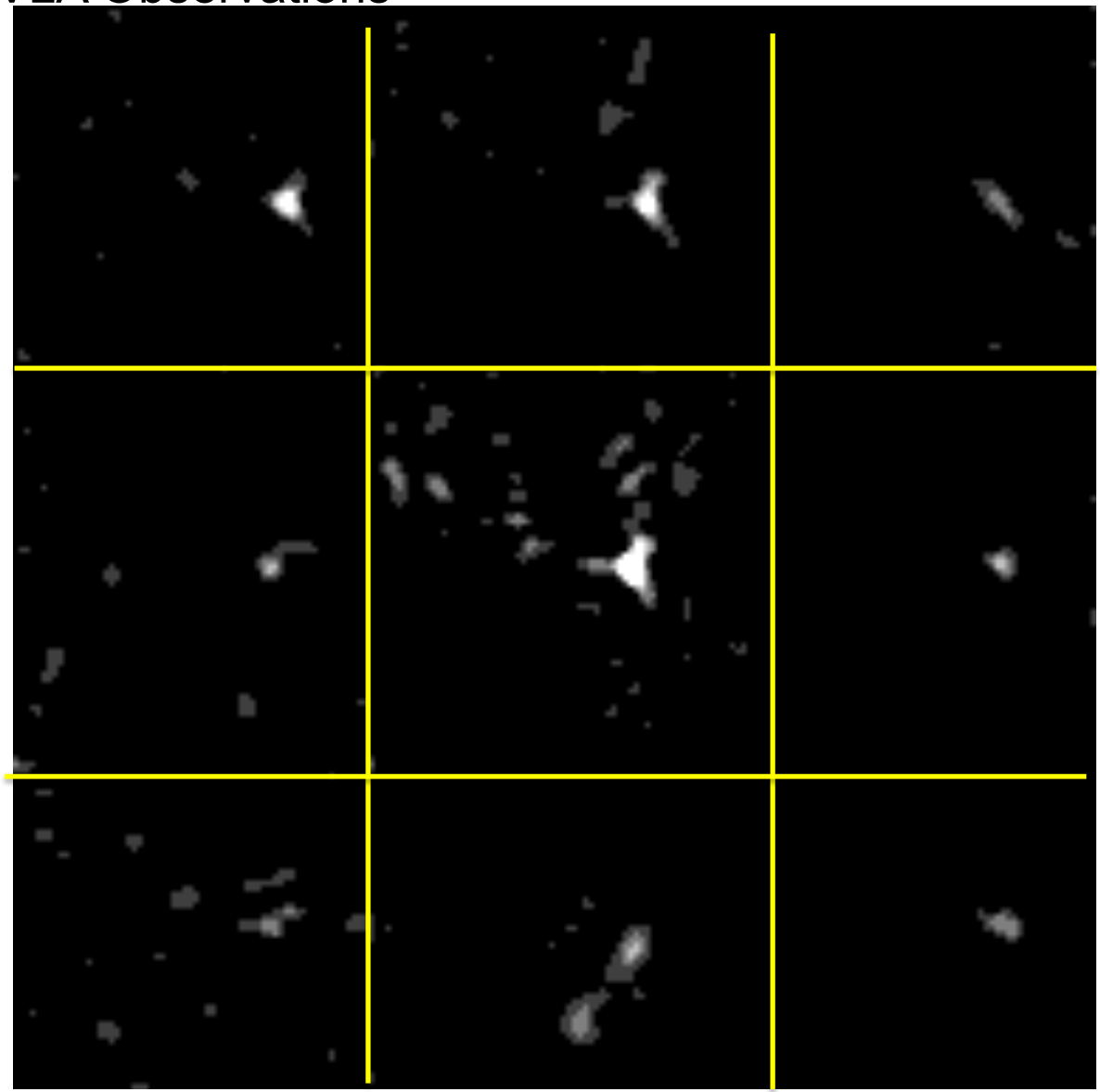
Ionospheric Effects



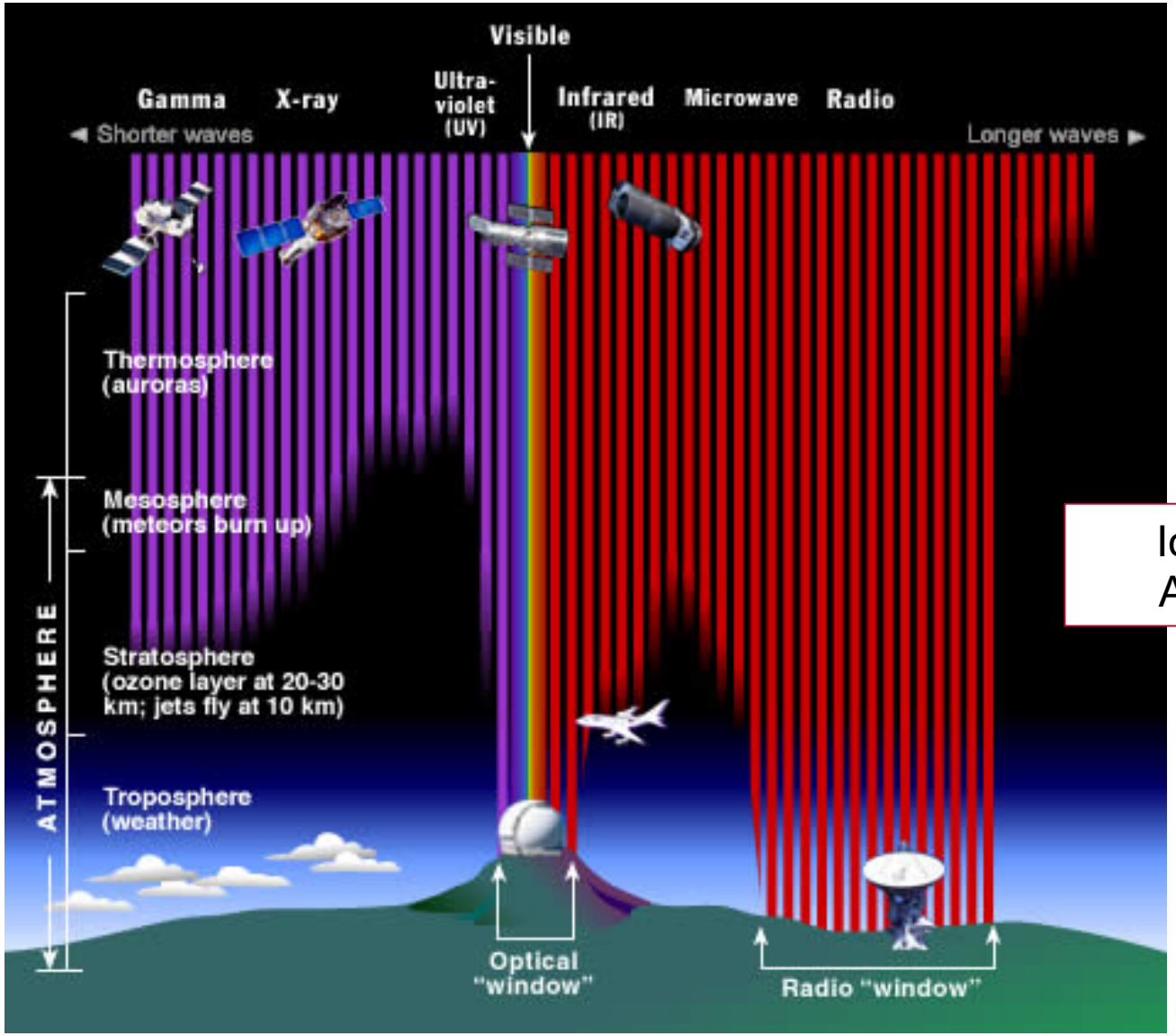
RadioJove/NASA

The Ionosphere in Action!

74 MHz VLA Observations



Radio Window is Wide Open!



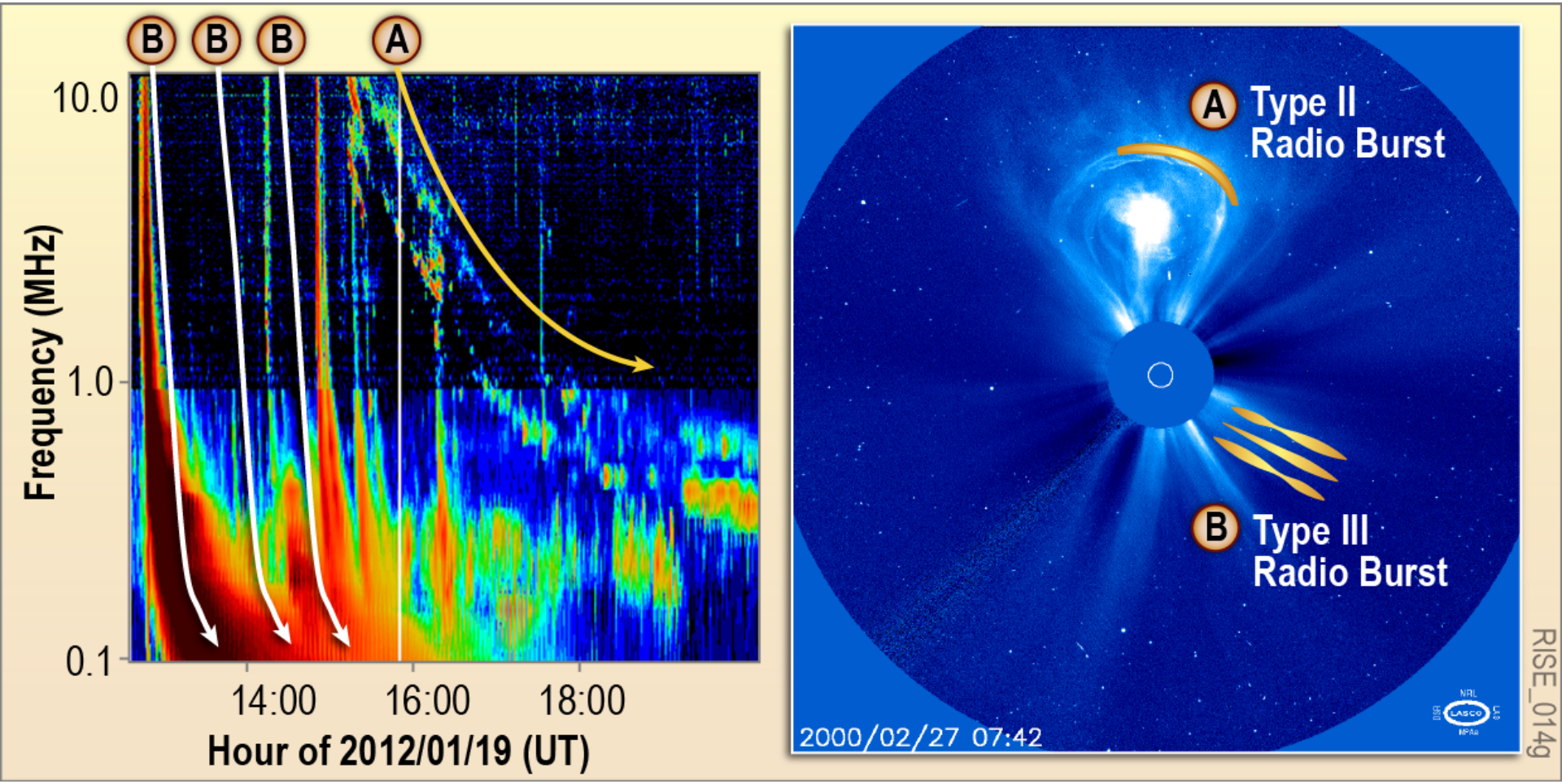
Or is it?

Ionospheric Absorption!

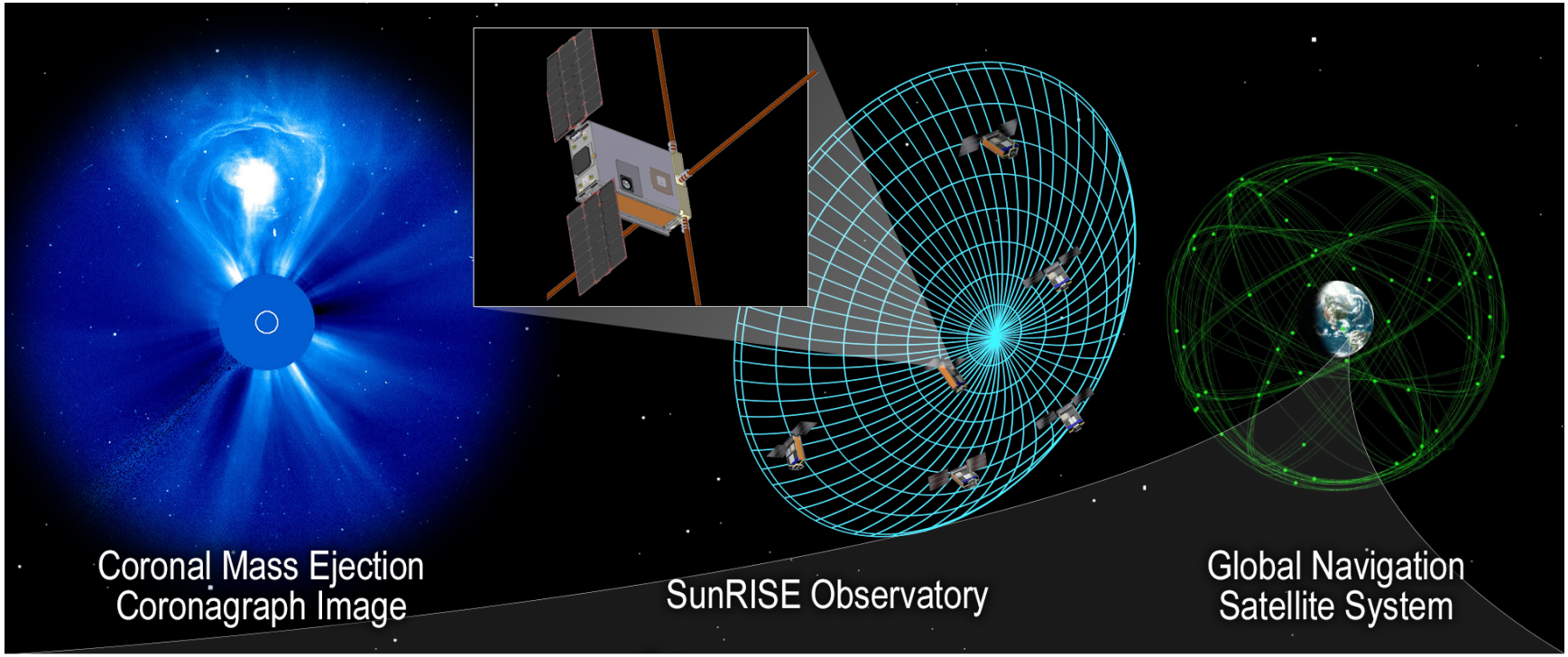
STScI/JHU/NASA

Solar Radio Emissions (Decametric-Hectometric)

Particle Acceleration and Transport

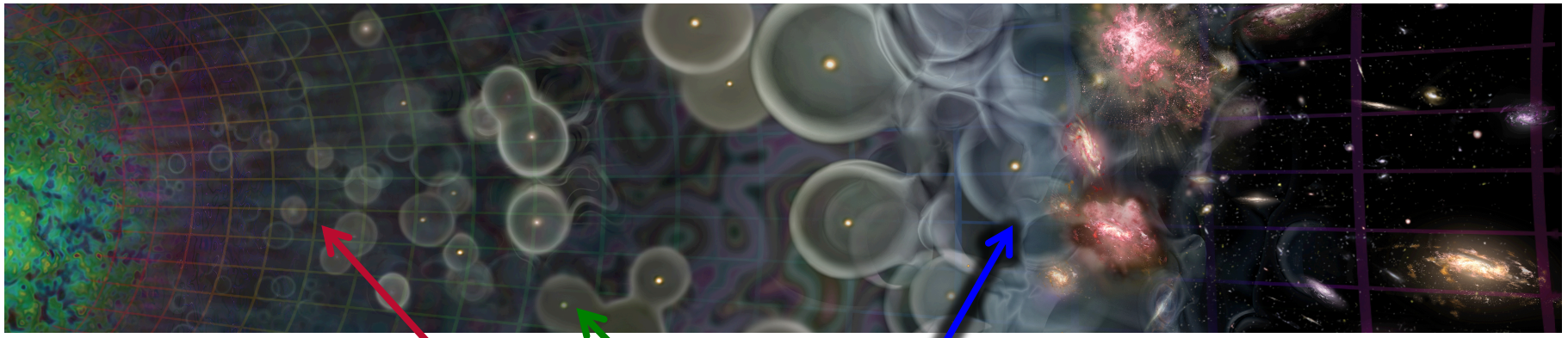


Sun Radio Interferometer Space Experiment (SunRISE)



Heliophysics SMEX Mission of Opportunity ($55M cost cap)	
Phase A	**2018 July 30**
Phase B	**2019 January *(notional, if selected)***
Launch	**2022 April *(notional)***

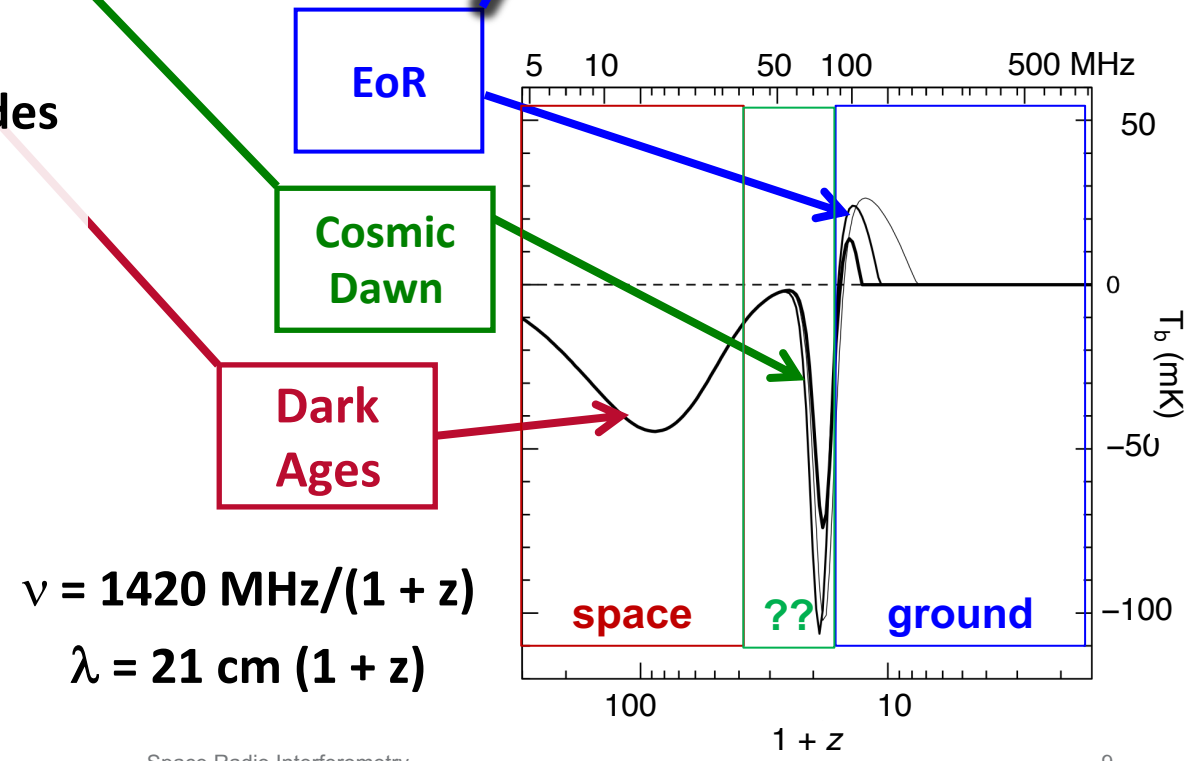
Hydrogen Signal from Cosmic Dawn and Dark Ages



Neutral Hydrogen 21 cm

spin-flip transition provides probe of neutral intergalactic medium before and during formation of first stars

Furlanetto, Oh, & Briggs "Cosmology at low frequencies: The 21 cm transition and the high-redshift Universe"



$\nu = 1420\ \text{MHz}/(1 + z)$

$\lambda = 21\ \text{cm}\ (1 + z)$

Cosmic Dawn

nature
International journal of science

Letter | Published: 28 February 2018

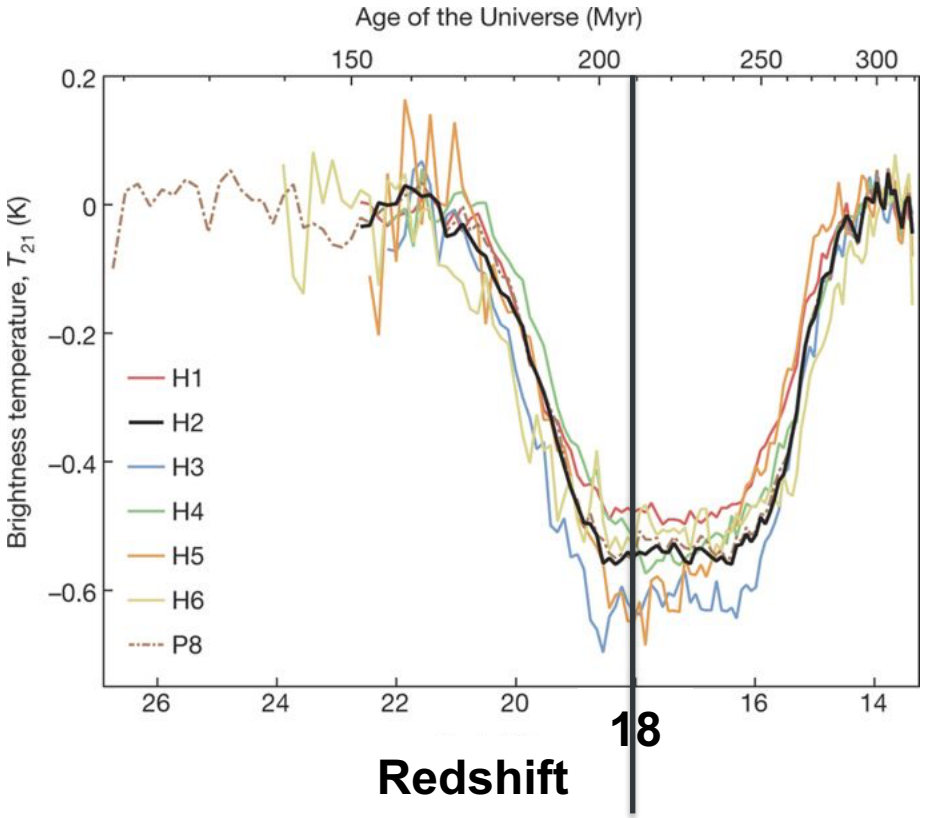
An absorption profile centred at 78 megahertz in the sky-averaged spectrum

Judd D. Bowman ✉, Alan E. E. Rogers, Raul A. Monsalve, Thomas J. Mozdzen & Nivedita Mahesh

Nature **555**, 67–70 (01 March 2018) | Download Citation ↓

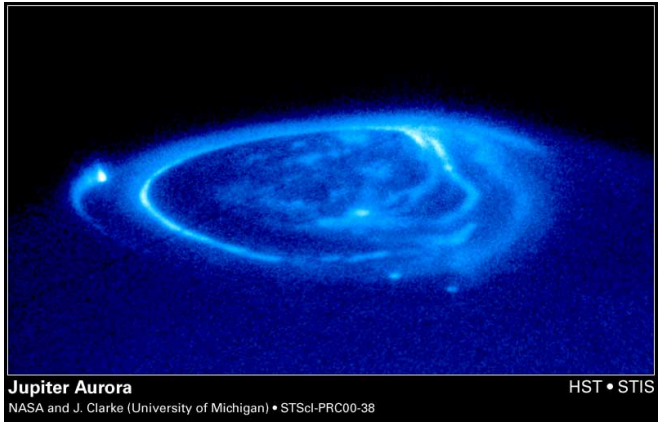
Abstract

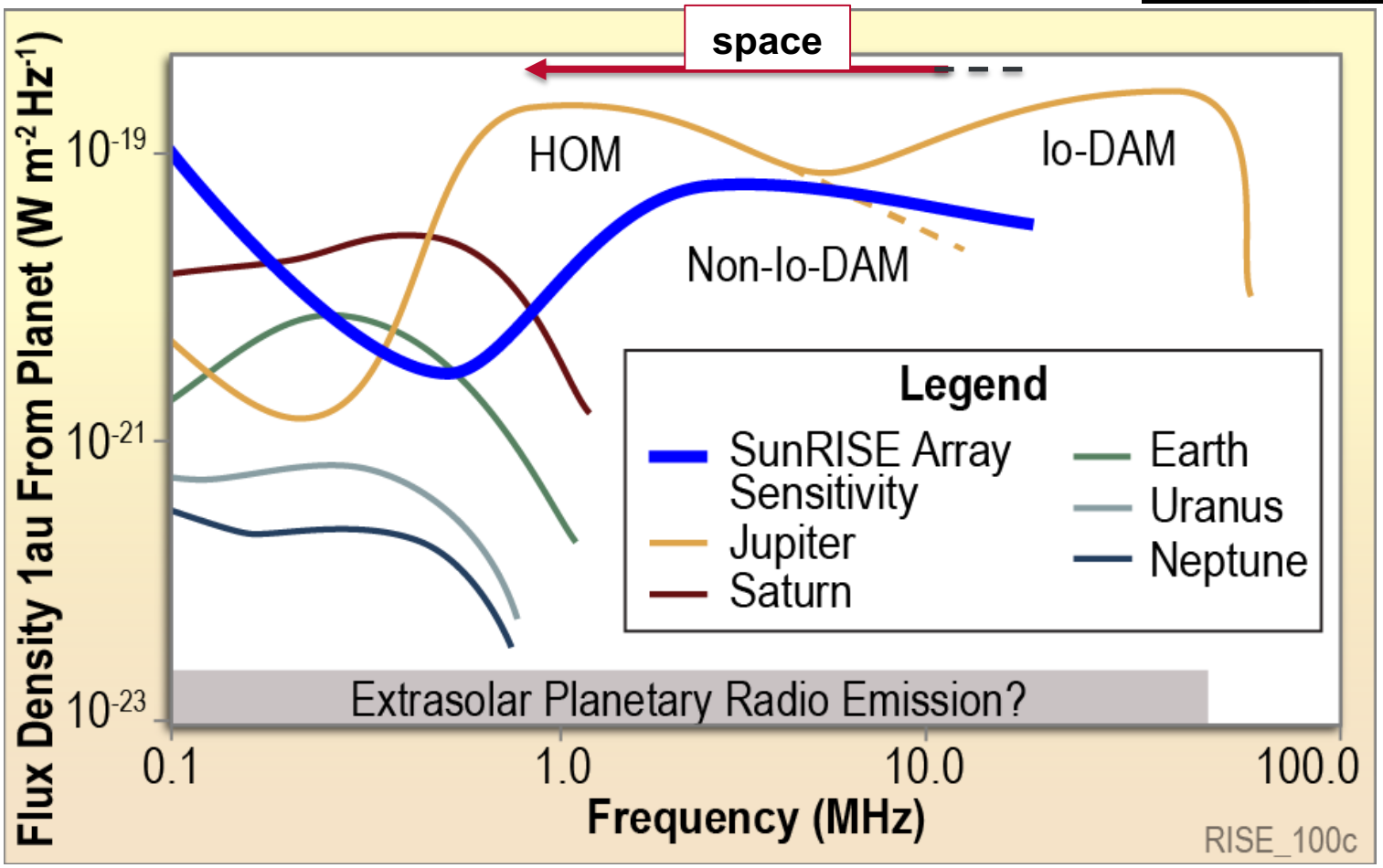
After stars formed in the early Universe, their ultraviolet light is expected, eventually, to have penetrated the primordial hydrogen gas and altered the excitation state of its 21-centimetre hyperfine line. This alteration would cause the gas to absorb photons from the cosmic microwave background, producing a spectral distortion that should be observable today at radio frequencies of less than 200 megahertz[1]. Here



Planetary Radio Emissions

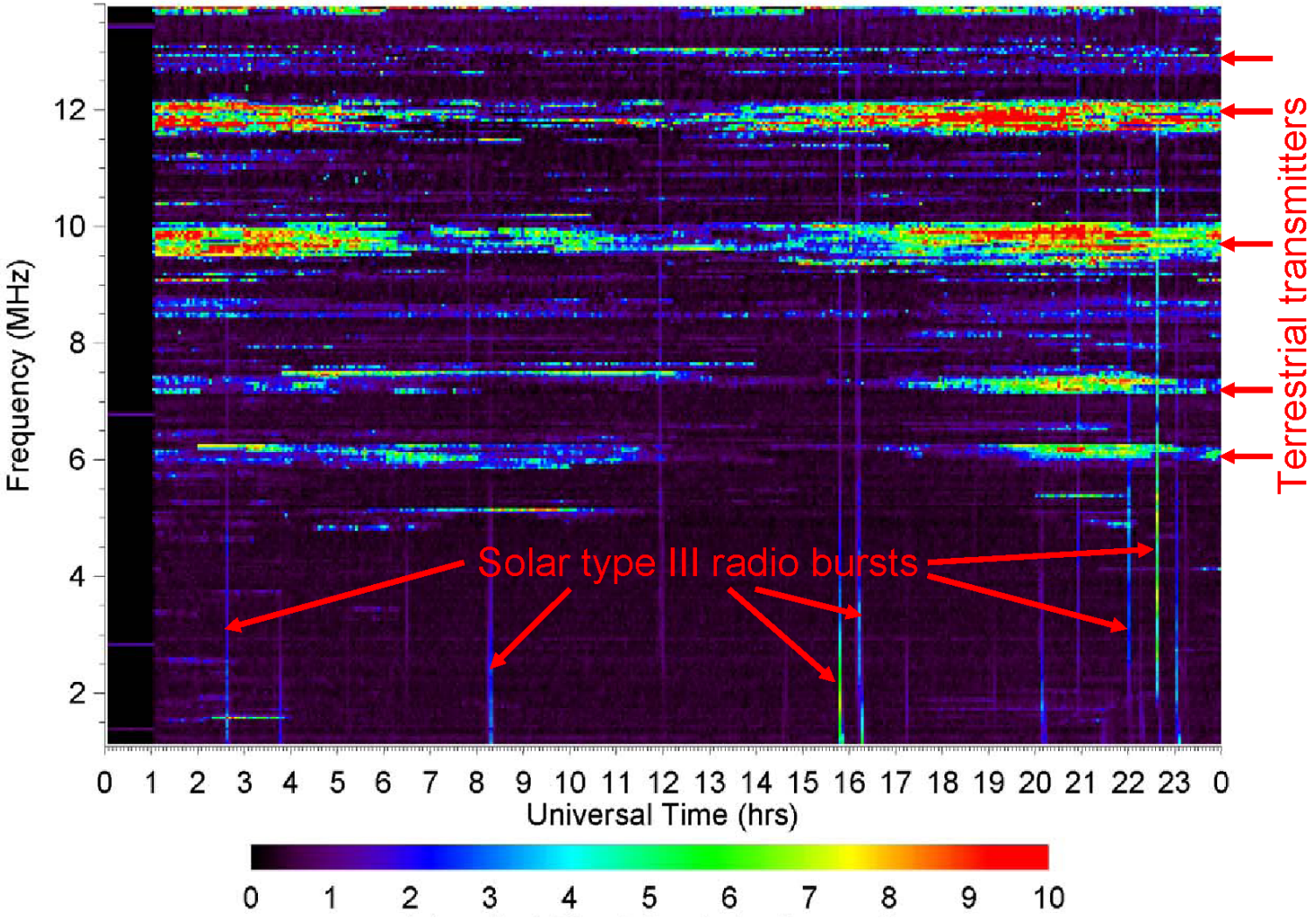
Magnetospheres and Habitability?



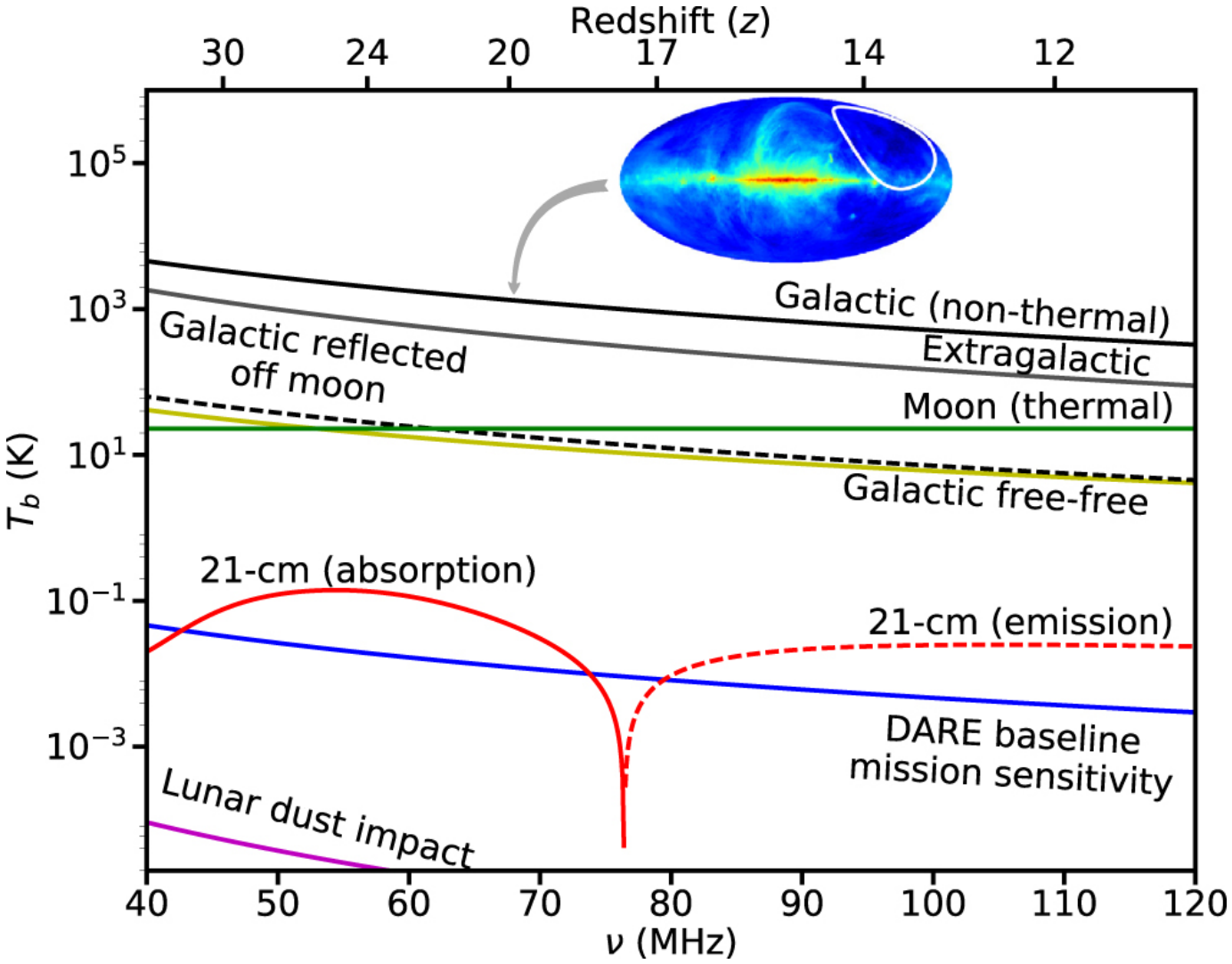


viz. W. M. Keck Institute for Space Studies "Planetary Magnetic Fields: Planetary Interiors and Habitability" (Lazio, Shkolnik, Hallinan, et al.)

Interference? I



Interference? II

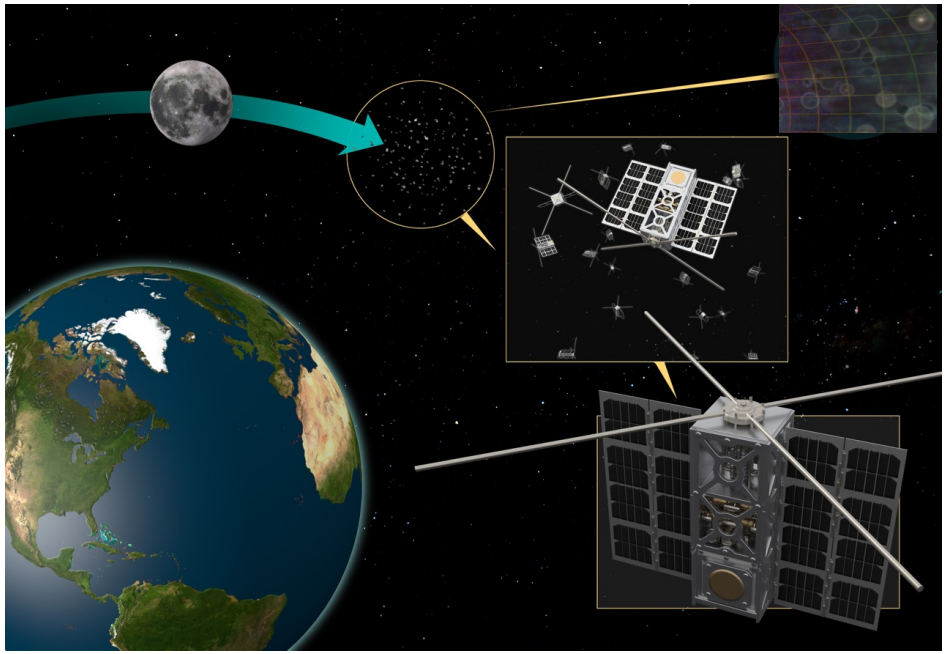


Burns et al.

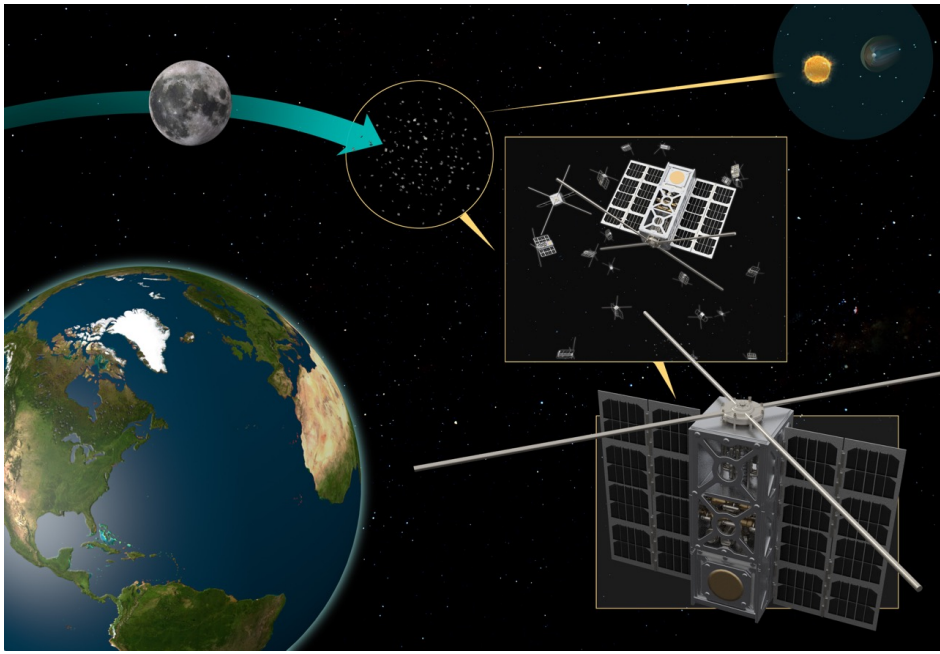
Space-Based Radio Astronomy

Compelling Science!

Neutral Hydrogen in the Cosmic Dark Ages



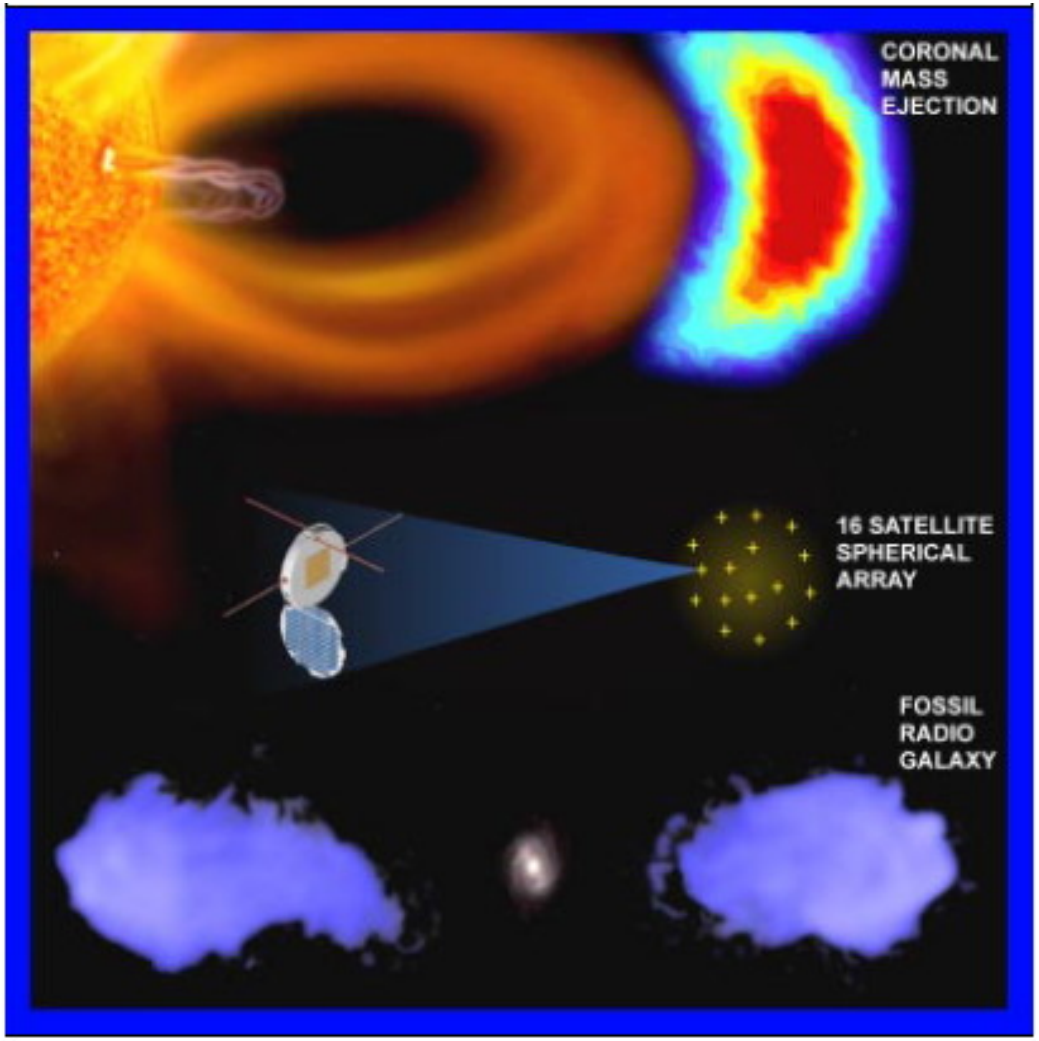
Extrasolar Planetary Magnetospheric Emissions



backup

Nothing New Under the Sun

Astronomical Low Frequency Array (ALFA) concept



cf. LFSA, SIRA, DARIS, FIRST, OLFAR, SURO, NOIRE, … concepts